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FINAL PLAN OF REMEDIAL ACTION

FORMER BABS REAL ESTATE PROPERTY

Minquadale, Delaware

DE - 1277



October 2004

Delaware Department of Natural Resources & Environmental Control
Division of Air and Waste Management
Site Investigation and Restoration Branch

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1.0 INTRODUCTION

The Former BABS Real Estate Property (site) is located in the Minquadale area, in New Castle County, Delaware (Figure 1), just south of the City of Wilmington. The site is approximately five (5) acres in size, and consists of undeveloped land that has been filled.

The owner of the property, Clifton Mill Associates (Clifton Mill), entered into a Voluntary Cleanup Program (VCP) Agreement with the Department of Natural Resources and Environmental Control (DNREC or the Department) under the provisions of the Delaware Hazardous Substance Cleanup Act (HSCA), 7 Del. C. Chapter 91. Under the VCP Agreement, Clifton Mill agreed to investigate the potential risks posed to public health, welfare and the environment. Clifton Mill contracted with Duffield Associates, Inc. (Duffield) to perform a Remedial Investigation (RI) of the site. Duffield performed a RI on the site in December 2002. The purpose of the RI was to evaluate the quality of surface soil, subsurface soil, and groundwater conditions on the site.

This document is the Department's final plan of remedial action (final plan) for the site. It is based on the results of all previous investigations performed at the site. This final plan is issued under the provisions of HSCA, 7 Del. C. Chapter 91 and the Regulations Governing Hazardous Substance Cleanup (Regulations). It presents the Department's assessment of the potential health and environmental risks posed by chemical contamination at the site.

As described in Section 12 of the Regulations, DNREC provided notice to the public and an opportunity for the public to comment on the proposed plan. During the comment period of August 2, 2004 through August 23, 2003, DNREC received no comments on the proposed plan and can subsequently issue this final plan. The final plan designates the selected remedy for the site. All prior investigations of the site, the proposed plan, and the final plan will constitute the remedial decision record.

Section 2 presents a summary of the site description, site history and previous investigations of the site. Section 3 provides a description of the remedial investigation results. Section 4 presents a discussion of the remedial objectives. Section 5 presents the proposed plan of remedial action. Section 6 discusses public participation requirements. Section 7 presents the declaration that the site has been determined to be protective of human health, welfare and the environment.

2.0 SITE DESCRIPTION AND HISTORY

The site is located in Minquadale, Delaware, east of Marsh Lane. It consists of one tax parcel, New Castle County tax parcel # 10-005.00-022, which is approximately five acres of undeveloped land. The site is bordered to the north by office and shop buildings occupied by the Corrado American, Inc. construction company, to the south by a small office building occupied by Petrillo Brothers, Inc., a residential neighborhood to the east, and the Delaware Recyclable Products, Inc. (DRPI) landfill to the west.

2.1 Site and Project History

The site is described as being a “filled-in portion of a quarry.” According to the 1993 United States Geological Survey map, the site is denoted as a “sand and gravel pit.” The site is no longer mined for sand and gravel. It is vacant land (no buildings or apparent structures are located on the property) that has been filled.

3.0 INVESTIGATION RESULTS

The remedial investigation (RI) performed by Duffield is the only environmental investigation previously performed at the site. The results are discussed below.

3.1 Remedial Investigation

In December 2002, Duffield Associates, Inc. (Duffield) excavated twelve (12) test pits (TP-1 through TP-12) in order to evaluate surface and subsurface soils on the site (Figure 2). From each test pit, one surface soil sample was collected from between 0 to 2 feet below ground surface (bgs), as well as one subsurface or deep soil sample collected as a composite of material located between depths of two feet bgs and the bottom of the test pit. The depths of the test pits varied across the site and were determined by either excavating to a depth where native material (orange sand) was encountered, excavating to a depth limited to the maximum reach of the backhoe, excavating to the depth of the groundwater table, or refusal. In general, native materials were found throughout TP-1, TP-6, TP-11, and TP-12. This native material was comprised of orange sand, mixed with varying amounts of silt and clay. Excavation of the remaining six (6) test pits indicated the presence of mostly fill materials, described as brown, fine to medium sand, with some silt. Pieces of brick, wood, glass, roofing, plastic, metal concrete reinforcement bars, asphalt, along other solid waste debris were randomly mixed in with the fill materials.

All soil samples were screened in the DNREC mobile laboratory and based on those results, a subset of the samples were sent to Severn Trent Laboratories, Inc. (STL) in Edison, New Jersey for confirmatory analysis. The initial screening results indicated the presence of polynuclear aromatic compounds (PAHs) in a majority of the soil samples. There were pesticides detected in the shallow soil sample collected from TP-5. Arsenic was identified as a “contaminant of concern” because it was detected above the Delaware background standard of 11 milligrams per kilogram (mg/kg) in three (3) samples. Arsenic was detected in samples TP-4 (Deep), TP-5 (Shallow), and TP-10 (Deep) at 19.7 mg/kg, 15.9 mg/kg, and 11.6 mg/kg, respectively. The screening results showed no indication of polychlorinated biphenyls (PCBs) or volatile organic compounds (VOCs) in any of the samples.

Ten (10) samples were sent to the STL laboratory for arsenic and PAH analysis – TP-2 (Shallow), TP-3 (Deep), TP-4 (Deep), TP-5 (Deep), TP-8 (Shallow), TP-8 (Deep), TP-10 (Shallow), TP-10 (Deep), TP-11 (Shallow), and TP-12 (Deep). In accordance with the workplan, two (2) additional samples were sent to the STL Laboratory to receive analysis of full Target

Analyte List/Target Compound List (TAL/TCL) parameters. The samples chosen for this analysis were: TP-2 (Deep) and TP-5 (Shallow). The lab results did not indicate the presence of VOCs above the method detection limits in any of the samples.

The laboratory results indicated the presence of arsenic above the Delaware background standard of 11 mg/kg in one sample, TP-5 (Shallow), as shown below:

SOILS – Results of Inorganic Analysis

SAMPLE IDENTIFICATION	TP-5 (Shallow)	DNREC URS for Protection of Human Health Non-Critical Water Resource Area (February 1999) RESTRICTED USE
Sample Depth (feet)	0 - 2	
Units (mg/kg)		
Arsenic	13.1	11.0

The laboratory results indicated the presence of semi-volatile organics at concentrations exceeding corresponding URS values, as shown below:

SOILS – Results of Semi-volatile Organic Analysis

SAMPLE IDENTIFICATION	TP-4 (Deep)	TP-5 (Deep)	TP-10 (Shallow)	TP-10 (Deep)	DNREC URS for Protection of Human Health Non-Critical Water Resource Area (February 1999) RESTRICTED USE
Sample Depth (feet)	2 - 14	2 - 13	0 - 2	2 - 14	
Units (mg/kg)					
SEMI-VOLATILE ORGANICS					
Benzo(a)anthracene	11	-	-	-	8
Benzo(b)fluoranthene	14	-	-	-	8
Benzo(a)pyrene	10	1.5	2.2	3.1	0.8
Dibenz(a,h)anthracene	12	-	-	-	0.8

The groundwater flow direction in the local area is towards the DRPI landfill and can be assessed by using the monitoring wells surrounding the landfill. Duffield also collected groundwater samples via three temporary wells on the site, W-1, W-2, and W-3. The wells were screened in the uppermost water-bearing zone. These samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs and TAL inorganic compounds. Prior to receipt by the laboratory, the samples collected for VOC analysis for W-3 froze and the containers burst. Therefore, data for these samples was not available.

GROUNDWATER

Sample Identification	W-1	W-2	W-3	DNREC URS for Protection of Human Health (February 1999)
	Units (µg/L)			
SEMI-VOLATILE ORGANICS				
Benzo(b)fluoranthene	-	-	1.2	0.09
METALS				
Aluminum	10,400	-	-	200
Beryllium	11.9	-	-	4
Chromium	118	-	-	11*
Iron	16800	562	-	300
Lead	33.5	-	-	15
Manganese	434	1410	-	50
Vanadium	339	-	-	26

*DNREC URS value for chromium VI

Although iron, aluminum and manganese are naturally-occurring elements in Delaware's groundwater and their URS values found in DNREC's remediation standards guidance documents are based on Secondary Maximum Contaminant Levels (SMCLs), the concentrations found in these samples are higher than are found to be naturally-occurring. This is likely due to sediment collected with the groundwater samples. SMCLs are based on aesthetic qualities of the water, such as taste and odor, and do not pose a risk to human health or the environment. Given the low soil concentrations, the presence of such elevated values for what is most likely chromium and vanadium is suggestive that the detections in groundwater are due to fine sediments. The chromium concentration found in W-1 represents total chromium. Since it is unknown whether the species is actually chromium III or chromium VI, it is assumed that the entire concentration in the sample is chromium VI because it poses a greater health risk than does chromium III.

No VOCs, or pesticides, were detected in any of the groundwater samples above DNREC URS values. The presence of benzo(b)fluoranthene further supports that fine sediments were most likely present in the groundwater samples because benzo(b)fluoranthene is nearly insoluble. It is rarely, if ever, detected dissolved in groundwater.

3.2 *Interim Action*

In November 2003, Duffield Associates, Inc. performed an interim action soil removal in order to reduce the carcinogenic risk posed by contaminated soils. Approximately 225 square feet of surface soils were removed from the area of TP-5 suspected of being a hot spot area. Two confirmatory samples were taken from the side walls of the excavation and both were analyzed for TCL base/neutral-extractable organic compounds and TCL pesticides and PCBs. The samples were submitted to the STL Laboratory for analysis. The data was then sent to Trillium, Inc. for validation.

3.3 *Summary*

The results of the lab analysis of ten (10) soil samples collected as part of the RI in December 2002 indicated that benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene were detected in TP-4 (Deep) and TP-5 (Shallow) at concentrations that exceeded corresponding restricted use URS values. Benzo(a)pyrene was detected in both TP-10 (Shallow) and TP-10 (Deep) at concentrations that exceeded corresponding URS values. VOCs were not detected at concentrations above the method detection limit in either TP-5 (Shallow) or TP-2 (Deep).

The results of the groundwater samples collected from W-1 and W-2, temporary wells installed on-site, indicated elevated concentrations of the following metals: iron, aluminum, chromium III, manganese and vanadium. Since concentrations of these metals in the soil samples collected were low, the elevated levels of these metals were likely due to fine sediment collected along with the groundwater samples. Benzo(b)fluoranthene was detected in the sample collected from W-3. No VOCs, or pesticides, were detected in any of the groundwater samples above DNREC URS values.

3.4 *Risk Evaluation*

As detailed in the RI, the cumulative risk posed to the construction/utility worker by the contaminants present in on-site soils was evaluated using the 95% upper confidence limit (UCL) of the arithmetic mean of each contaminant. The cumulative risk for this exposure scenario was 1.8×10^{-6} , which does not exceed the acceptable level of excess cancer risk of 1.0×10^{-5} . The non-cancer risk posed in this scenario by the contaminants present in the soil was 0.0014, which does not exceed a Hazard Index of 1.0.

Following the interim action, the carcinogenic risk posed to an on-site commercial/industrial worker due to exposure to surface soils was evaluated using the highest concentration of each contaminant found in surface soil. This risk was calculated to be 1.0×10^{-5} . Assuming unrestricted use, the carcinogenic risk posed by the site was 1.6×10^{-4} . There was no non-cancer risk associated with the contaminants present in soils. Since the carcinogenic risk, assuming unrestricted use, is greater than 1×10^{-5} , but the risk assuming restricted use does not exceed 1.0×10^{-5} , no active remedial actions are required for soils. However, institutional controls are necessary to ensure the land use remains restricted to commercial/industrial use in the future.

The carcinogenic risk posed by groundwater contamination was calculated to be 1.3×10^{-5} , which exceeds the acceptable level of excess cancer risk of 1×10^{-5} . The non-cancer risk was calculated to be 3.6, which exceeds the DNREC standard of a Hazard Index equal to 1.0. This site is adjacent to an active industrial waste landfill. Groundwater immediately downgradient of this site will continue to be monitored under DNREC's Solid Waste Program.

4.0 REMEDIAL ACTION OBJECTIVES

According to Section 8.4(1) of the Regulations, site-specific remedial action objectives (RAOs) must be established for all plans of remedial action. The Regulations provide that DNREC set objectives for land use, resource use, and cleanup levels that are protective of human health and the environment.

Qualitative objectives describe, in general terms, what the ultimate result of the remedial action, if necessary, should be. The following qualitative objectives are determined to be appropriate for the site:

- Prevent human exposure to soils in an unrestricted use setting, and
- Prevent human exposure to groundwater via human consumption.

These objectives are consistent with the proposed use of the site as a garage/workshop building with associated paved parking, New Castle County zoning policies, state regulations governing water supply, and worker health and safety.

Quantitative objectives define specific levels of remedial action to achieve protection of human health and the environment. Based on the above qualitative objectives, the quantitative objectives will be to ensure that future site users are not exposed to contaminated soils that present a cancer risk of greater than 1×10^{-5} in a restricted land use setting, and also do not consume contaminated groundwater that poses a risk greater than 1×10^{-5} .

5.0 FINAL PLAN OF REMEDIAL ACTION

Based on DNREC's evaluation of the site information and the above remedial action objectives, the recommended actions for the site will include the following:


- Placement of a deed restriction on the property within ninety (90) days following DNREC's adoption of the final plan : a) prohibiting current and future residential use of the property; and b) prohibiting the installation of any water wells on, or use of groundwater at, the site without the prior written approval of DNREC, and will identify the site as located within a groundwater management zone (GMZ), which is an internal DNREC document that restricts groundwater withdrawals at the site.
- Development and implementation of an Operation and Maintenance (O&M) plan submitted to DNREC for approval within 90 days following DNREC's adoption of the final plan. The O&M plan must address the need to evaluate and make recommendations as to the conditions of groundwater at the site, as part of a 5-year remedy review. If sufficient groundwater information is not available to perform this assessment, additional groundwater sampling may be required at that time.

6.0 PUBLIC PARTICIPATION

The Department actively solicited public comments or suggestions on the proposed plan of remedial action. The public comment period began on August 2, 2004 and ended at the close of business on August 23, 2004. No comments were received during the public comment period.

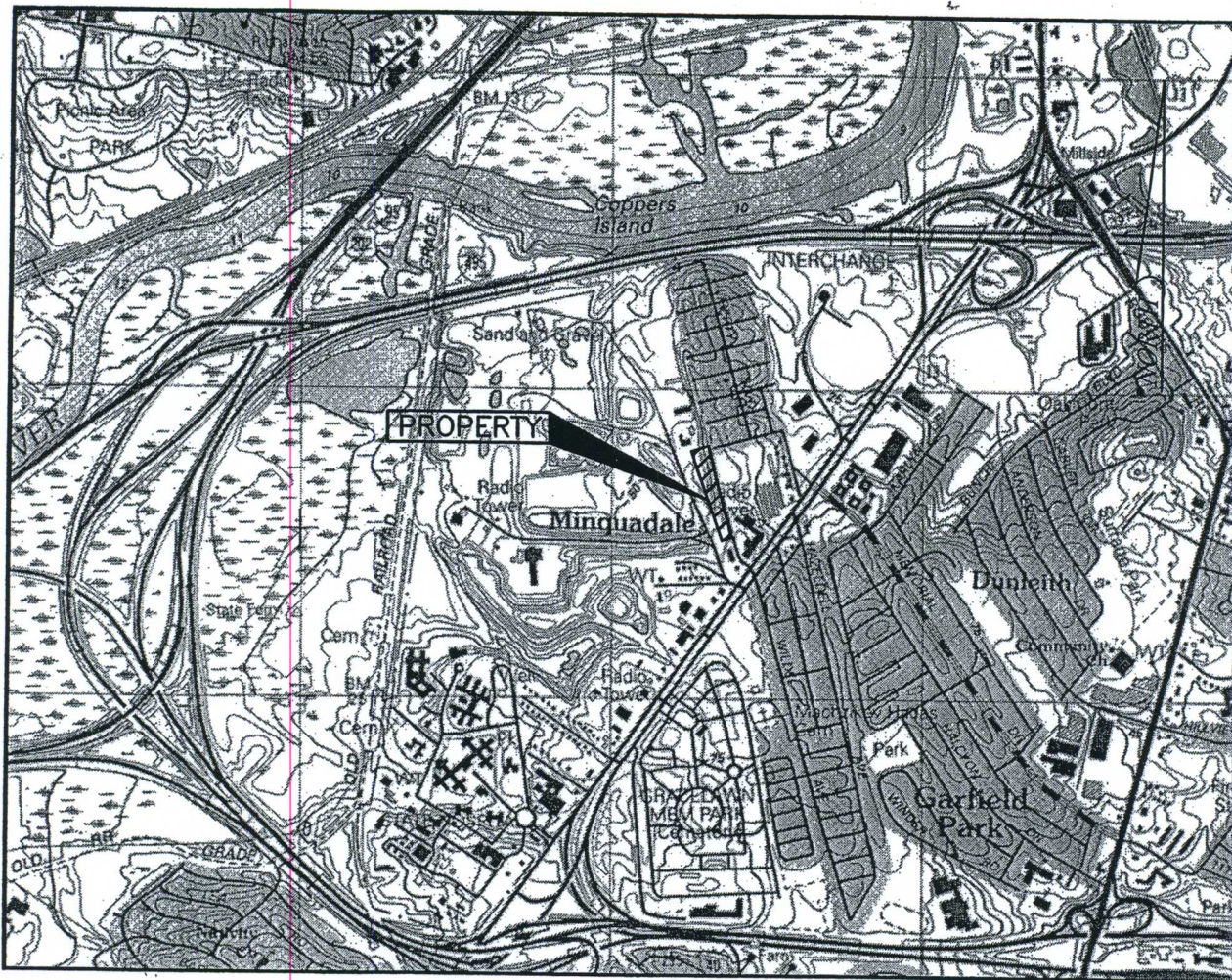
7.0 DECLARATION

This final plan of remedial action for the Former BABS Real Estate Property is protective of human health, welfare, and the environment and is consistent with the requirements of the Delaware Hazardous Substance Cleanup Act.


John Blevins
Director, Division of Air and Waste


Date of Review

LJH/dp
LJH04031.doc
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NOTE:

THIS LOCATION SKETCH IS ADAPTED FROM THE U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, FOR WILMINGTON SOUTH, DELAWARE 1993.

DATE:
5 MARCH 2003

SCALE:
1"=2000'

W.O. NO.
4989.ED

SHEET:
FIGURE 1

LOCATION SKETCH

FORMER BABS

REAL ESTATE PROPERTY

WILMINGTON ~ NEW CASTLE COUNTY ~ DELAWARE

DESIGNED BY: JLG

DRAWN BY: JGE

CHECKED BY:

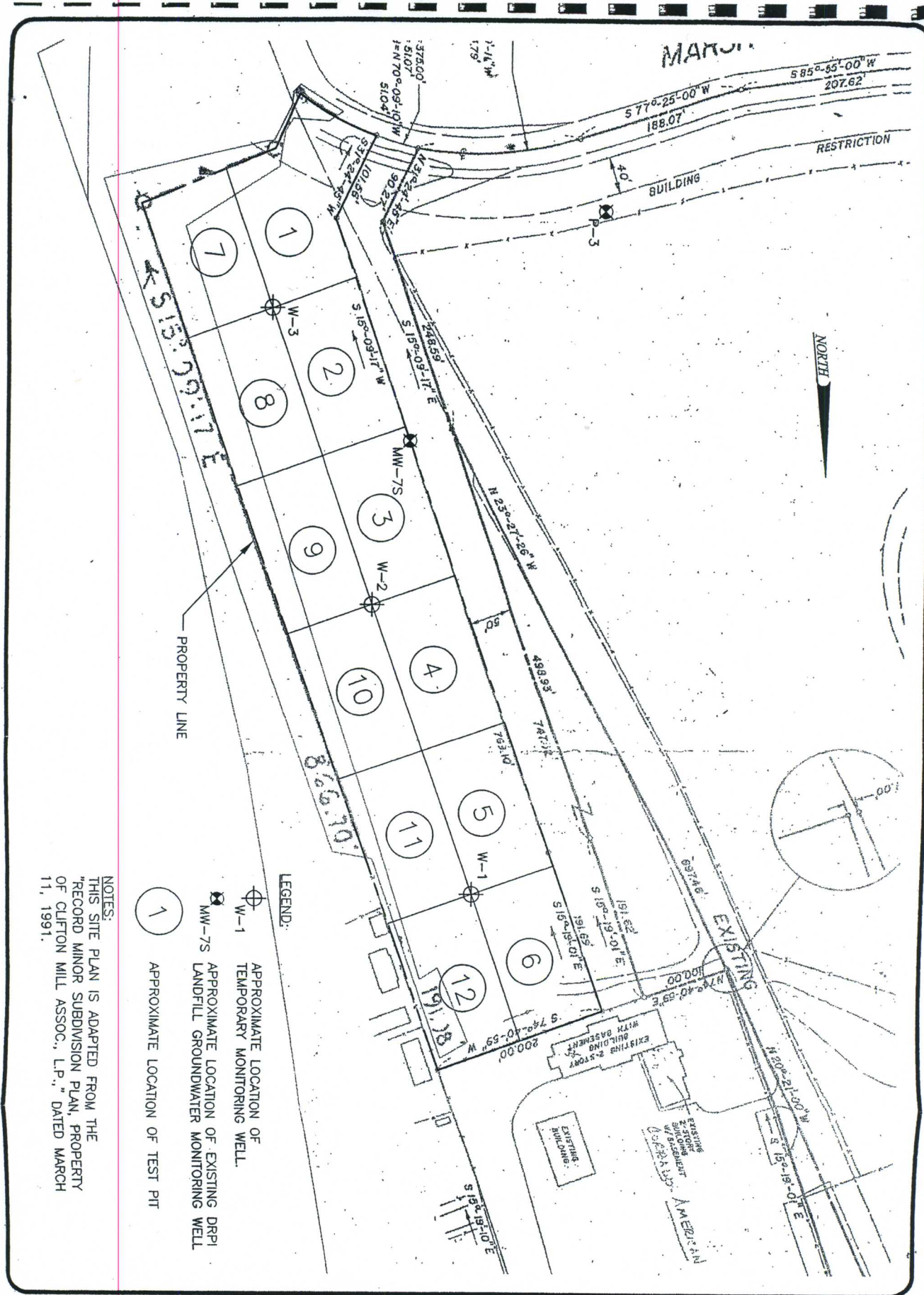
FILE: A-4989ED-01

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SAMPLE LOCATION SKETCH

FORMER BABS REAL ESTATE PROPERTY

MINQUADALE ~ NEW CASTLE COUNTY ~ DELAWARE

DESIGNED BY: JLG
 DRAWN BY: JGE
 CHECKED BY:
 FILE: B4989EB03

DUFFIELD ASSOCIATES
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 1528 WALNUT STREET, SUITE 723
 PHILADELPHIA, PA 19103
 E-MAIL: DUFFIELD@DUFFIELD.COM

DATE: 5 MARCH 2003
 SCALE: 1"=100'
 W.O. NO. 4989/EC
 SHEET: FIGURE 2

APPENDIX A

SUMMARY OF RISK ASSESSMENT CALCULATIONS

FORMER BABS REAL ESTATE PROPERTY
MINQUADALE, DELAWARE

Substance	CPSo	RfDo	95% UCL (mg/kg)	Estimated Cancer Risk	Estimated Hazard Quotient
Acenaphthene	NA	0.060	3.2	NA	0.00014
Fluorene	NA	0.040	3.5	NA	0.00022
Phenanthrene	NA	NA	4.7	NA	NA
Anthracene	NA	0.30	4.0	NA	0.000035
Carbazole	2.0E-02	NA	5.6	4.1E-09	NA
Fluoranthene	NA	0.040	4.8	NA	0.00031
Pyrene	NA	0.030	4.7	NA	0.00041
Benzo(a)pyrene	7.3E+00	NA	3.0	8.1E-07	NA
Chrysene	7.3E-03	NA	3.1	8.4E-10	NA
Benzo(b)fluoranthene	7.3E-01	NA	3.2	8.6E-08	NA
Benzo(k)fluoranthene	7.3E-02	NA	2.8	7.6E-09	NA
Benzo(a)anthracene	7.3E-01	NA	3.1	8.2E-08	NA
Ideno(1,2,3-cd)pyrene	7.3E-01	NA	2.7	7.4E-08	NA
Dibenz(a,h)anthracene	7.3E+00	NA	2.6	7.0E-07	NA
Benzo(g,h,i)perylene	NA	NA	3.0	NA	NA
Aroclor-1248	NA	2.0	4.9	NA	0.0000063
Aroclor-1260	NA	2.0	5.8	NA	0.0000075
4,4'DDD	NA	0.24	9.2	NA	0.00010
4,4'DDE	NA	0.34	8.4	NA	0.000064
4,4'DDT	5.0E-04	0.34	13	2.5E-10	0.00010
CUMULATIVE ESTIMATED CANCER RISK (OR HAZARD INDEX) =				1.8E-06	0.0014

EQUATIONS USED TO CALCULATE CANCER RISK

RBC Equation for Commercial/Industrial Soil Ingestion, Carcinogenic Compounds	Cancer Risk Equation (Derived from RBC Equation)
$RBC = \frac{(TR)(BWa)(ATc)}{(EFo)(EDo)[(IRSa/10^6)(FC)(CPSo)]}$	$TR = \frac{(RBC)(EFo)(EDo)[(IRSa/10^6)(FC)(CPSo)]}{(BWa)(ATc)}$

EQUATIONS USED TO CALCULATE HAZARD INDEX

RBC Equation for Commercial/Industrial Soil Ingestion, Non-Carcinogenic Compounds	Hazard Index Equation (Derived from RBC Equation)
$RBC = \frac{(THQ)(RfDo)(BWa)(ATn)}{(EFo)(EDo)(IRSa/10^6)(FC)}$	$HI = THQ = \frac{(RBC)(EFo)(EDo)(IRSa/10^6)(FC)}{(RfDo)(BWa)(ATn)}$

CONSTANTS			COMPOUND-SPECIFIC VARIABLES	
ATc	Averaging time carcinogens (days)	= 25,550	CPSo	Carcinogenic potency slope oral (see above)
IRSa	Soil ingestion, adult (milligrams/day)	= 330	RBC	Risk-Based Concentration (see above)
EFo	Exposure frequency (days/year)	= 200	RfDo	Reference dose oral (see above)
EDo	Exposure duration (years)	= 1	TR	Target cancer risk (see above)
FC	Fraction of contaminated soil ingested (unitless)	= 1	HI	Hazard Index (see above)
BWa	Body weight, adult (kg)	= 70		
ATn	Averaging time non-carcinogens (days)	= EDo (365)		
THQ	Target Hazard Quotient (unitless)			

Notes:

1. NA=Not Applicable
2. This table is part of a March 2003 report entitled "Remedial Investigation, Former BABS Real Estate Property," and should be viewed only in that context.

APPENDIX B

SUMMARY OF RISK ASSESSMENT CALCULATIONS SCENARIO: NON-RESIDENTIAL EXPOSURE TO SHALLOW SOIL

FORMER BABS REAL ESTATE PROPERTY MINQUADALE, DELAWARE

Substance	Highest Detected Concentration (mg/kg)	RfDo	CSFo	Estimated Hazard Quotient	Estimated Cancer Risk
Acenaphthene	0.69	6.0E-02	NA	0.00001	NA
Fluorene	0.55	4.0E-02	NA	0.00001	NA
Phenanthrene	3.8	NA	NA	NA	NA
Anthracene	1.1	3.0E-01	NA	0.000004	NA
Carbazole	0.51	NA	2.0E-02	NA	4E-09
Fluoranthene	6.4	4.0E-02	NA	0.0002	NA
Pyrene	8.3	3.0E-02	NA	0.0003	NA
Benzo(a)anthracene	4.7	NA	7.3E-01	NA	1E-06
Chrysene	5.0	NA	7.3E-03	NA	1E-08
Benzo(b)fluoranthene	3.2	NA	7.3E-01	NA	8E-07
Benzo(k)fluoranthene	3.0	NA	7.3E-02	NA	8E-08
Benzo(a)pyrene	3.0	NA	7.3E+00	NA	8E-06
Indeno(1,2,3-cd)pyrene	1.3	NA	7.3E-01	NA	3E-07
Dibenz(a,h)anthracene	0.43	NA	7.3E+00	NA	1E-06
Benzo(g,h,i)perylene	1.2	NA	NA	NA	NA
Aroclor-1248	0.32	NA	2.0E+00	NA	2E-07
Aroclor-1254	0.52	2.0E-05	2.0E+00	0.03	4E-07
4,4'DDE	0.068	NA	3.4E-01	NA	8E-09
4,4'DDT	0.040	5.0E-04	3.4E-01	0.0001	5E-09
Methoxychlor	0.012	5.0E-03	NA	0.000002	NA
ESTIMATED HAZARD INDEX OR CUMULATIVE CANCER RISK =				0.03	1E-05

EQUATIONS USED TO CALCULATE CANCER RISK

RBC Equation for Commercial/Industrial Soil Ingestion, Carcinogenic Compounds	Cancer Risk Equation (Derived from RBC Equation)
$RBC = \frac{(TR)(BWa)(ATc)}{(EFo)(EDo)((IRSa/10^6)(FC)(CSFo)}$	$TR = \frac{(RBC)(EFo)(EDo)((IRSa/10^6)(FC)(CSFo)}{(BWa)(ATc)}$ <p>(Calculated Cancer Risk)</p>

EQUATIONS USED TO CALCULATE HAZARD INDEX

RBC Equation for Commercial/Industrial Soil Ingestion, Non-Carcinogenic Compounds	Hazard Index Equation (Derived from RBC Equation)
$RBC = \frac{(THQ)(RfDo)(BWa)(ATn)}{(EFo)(EDo)(IRSa/10^6)(FC)}$	$THQ = \frac{(RBC)(EFo)(EDo)(IRSa/10^6)(FC)}{(RfDo)(BWa)(ATn)}$

CONSTANTS			COMPOUND-SPECIFIC VARIABLES	
ATc	Averaging time carcinogens (days)	= 25,550	CSFo	Carcinogenic slope factor oral (see above)
IRSa	Soil ingestion, adult (milligrams/day)	= 100	RBC	Risk-Based Concentration (see above)
EFo	Exposure frequency (days/year)	= 250		(Calculated 95% UCL in mg/kg)
EDo	Exposure duration (years)	= 25	RfDo	Reference dose oral (see above)
FC	Fraction of contaminated soil ingested (unitless)	= 1	TR	Target cancer risk (see above)
BWa	Body weight, adult (kg)	= 70	HI	Hazard Index = sum of THQs (see above)
ATn	Averaging time non-carcinogens (days)	= ED0 (365)		(unitless)
THQ	Target Hazard Quotient (unitless)			

Notes:

1. NA=Not Applicable
2. mg/kg= milligrams per kilogram
3. This table is part of a February 2004 report entitled "Remedial Investigation, Former BABS Real Estate Property," and should be viewed only in that context.